March 29, 1855.

THOMAS BELL, Esq., V.P., in the Chair.

The following communications were read:—

I. "On the existence of an element of Strength in beams subjected to Transverse Strain, arising from the Lateral Action of the fibres or particles on each other, and named by the author the 'Resistance to Flexure.'" By PETER WILLIAM BARLOW, Esq., F.R.S. Received February 23, 1855.

The author commences by observing, that under the existing theory of beams, which recognizes only two elements of resistance, namely tension and compression, the strength of a beam of cast iron cannot be reconciled with the results of experiments on the direct tensile strength, if the neutral axis is in the centre of the beam.

He then proceeds to describe experiments made on two solid beams of cast iron to determine the position of the neutral axis. The beams employed were 7 feet long, 6 inches deep and 2 inches thick, on each of which small vertical ribs were cast, 12 inches apart; nine small holes were drilled opposite to each other in each rib, for the purpose of inserting the pins of a delicate measuring instrument. The distances of the holes of the centre division of both beams were measured under various strains, and the results show that the extensions and compressions proceed in an arithmetical ratio from the centre to the upper and lower sides of the beam; and that at any given distance on either side of the centre, the amount of extension is equal to the amount of compression.

The position of the neutral axis being thus conclusively ascertained to be in the centre, it is shown that, not only the ultimate strength,

but also the amount of extension and compression with a given strain, indicates the existence of another element of resistance, in addition to the resistances to extension and compression.

The author then points out, that in applying the law of "*ut tensio sic vis*" to contiguous fibres, under different degrees of extension and compression, the effect of the lateral adhesion has been omitted, and each fibre has been supposed to be capable of taking up the same degree of extension or compression as if it acted separately, and independently of the adjoining fibres.

It is then shown that this supposed independent action of the fibres is inconsistent with other practical results, and evidence is exhibited of a powerful lateral action when unequal strains are exerted.

From these and other considerations, the author is led to think that the effect of the lateral action, tending to modify the effect of the unequal and opposite strains in a beam, constitutes, in effect, a "resistance to flexure" acting in addition to the resistances of tension and compression.

In order to ascertain whether the apparent difference in the amount of tensile strength when excited by direct and transverse strains is due to *flexure*, the author caused open beams or girders to be made, each of which was formed by two bars of metal; the upper and lower bars of the same beam were in every case of the same form and dimensions; but the depth of metal and the distance to which the bars were separated vertically, was varied in the several forms of girder experimented upon. By these means the bar forming the lower side of each girder was torn asunder under different degrees of flexure. The different forms of girder experimented upon were of equal length, and were compared with solid beams and with bars of the same metal broken by direct tensile strain.

From the mean of *four* experiments on each form of girder, the value of the total resistance at the outer fibre is ascertained, and exhibits the following results:—

1. In girders having the same depth of metal, namely about 2 inches, but the total depth of the girder, and consequently the deflections, different—

Form of beam or girder.	Depth of girder.	Deflection.	Total resistance at the outer fibre.
			lbs.
No. 1. Solid beam	2·02	·670	41709
No. 2. Open girder	2·51	·510	35386
No. 3. Open girder	3·00	·401	31977
No. 4. Open girder	4·00	·301	28032

2. In girders having the same total depth (namely 4 inches), and consequently nearly the same deflection, but differing in the depth of metal—

Form of beam or girder.	Depth of metal.	Total resistance at the outer fibre.
		lbs.
No. 5. Open girder	3·01	37408
No. 4. Open girder	1·97	28032
No. 7. Open girder	1·56	27908
No. 6. Open girder	1·48	25271
The tensile strength of the metal employed was found to be		18750

From these experiments, the particulars of which are fully detailed, the following facts are elicited:—

1. That in all cases the total resistance at the outer fibre, at the time of rupture, is greater than the tensile strength.

2. That in girders having the same depth of metal, it increases when the deflection increases; and

3. That in girders having the same total depth, and the same deflection, the resistance is greater when the depth of metal in the beam is greater.

And it follows that there is an element of strength depending on the depth of metal in connexion with the deflection; or in other words, dependent on the *degree* of *flexure* to which the metal forming the beam is subjected.

The author next proceeds to examine the law under which this resistance varies; and considering the total resistance in the solid beam to be composed of two resistances, one being constant and due to the tensile strength, and the other variable and depending on the depth of the metal in connexion with its deflection, the experiments indicate that the resistance to flexure varies, throughout all

the girders, directly as the amount of deflection into the depth of the metal.

The paper concludes by pointing out the important amount of this resistance, the operation of which has been hitherto unknown, and which in cast iron exceeds the tensile strength of the metal, and shows that comparisons of the strength of different forms of section, based on the existing theory, which assumes the resistance at the outer fibre to be constant and equal to the tensile strength of the metal, must be entirely fallacious.

The paper is accompanied by full details of all the experiments, and the measurements for determining the position of the neutral axis.

II. "On the Metallic and some other Oxides, in relation to Catalytic Phenomena." By the Rev. J. EYRE ASHBY. Communicated by the Rev. JOHN BARLOW, F.R.S. Received March 8, 1855.

I purpose to detail some experiments on the metallic (and a few other) oxides, made with a view to ascertain their powers to produce and maintain, catalytically, the combustion of various gases and vapours; and to annex such considerations as appear to be suggested by the facts. By catalysis I understand the operation of one body upon another, under favourable circumstances, whereby the second body is resolved into new chemical combinations, while the first (whatever may happen during the process) remains finally unchanged. This must be taken as not including explosion by percussion, in which the change takes place owing to the external application of dynamic force.

The apparatus for experimenting comprehends a variety of shallow capsules; wire-gauze, of iron, copper, and brass, of different degrees of fineness, cut into discs a little larger than the vessels on which they are to be superimposed; a spirit-lamp with large wick; a pair of pliers, and a few rings of wire to support the gauze, if necessary, while heating it in the spirit flame. The method of procedure is simple: the watch-glass, or capsule, is *nearly* filled with